

December 13, 2001

MEMORANDUM

SUBJECT: **Lindane** (009001) Reregistration Case No. 0315. Revised Anticipated Residues, Acute and Chronic Dietary Exposure and Risk Analyses for the HED Human Health Risk Assessment. DP Barcode D279260.

FROM: Thurston G. Morton, Chemist  
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THROUGH: David Soderberg, Chemist  
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and

Susan V. Hummel, Branch Senior Scientist  
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TO: Rebecca Daiss, Risk Assessor  
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and

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Special Review & Reregistration Division (7508C)

**Action Requested**

Prepare the revised anticipated residues and acute, chronic, and cancer dietary exposure and risk analyses for lindane (009001) incorporating comments from the public and deleting seed treatment uses on broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, radishes, and spinach which are no longer being supported for reregistration by Inquinosa. The OPP/Cancer Assessment Review Committee (CARC) has completed the review of newly submitted carcinogenicity study in CD-1 mice

along with other data. In accordance with the EPA Draft Guidelines for Carcinogen Risk Assessment (July, 1999), the CARC has classified lindane into the category "**Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential**" based on an increased incidence of benign lung tumors in female mice only. The Committee, therefore, recommended that the quantification of human cancer risk is not required.

## **Executive Summary**

- Estimated acute dietary exposure is below HED's level of concern for all population subgroups at the 99.9<sup>th</sup> percentile. The maximum dietary risk estimate is 17 % of the acute PAD (% aPAD) for the population subgroup All Infants (Table 18) and 7 % of the aPAD for the U.S. Population when the feeding studies were adjusted using the metabolism studies.
- Estimated chronic dietary risk is below HED's level of concern for all population subgroups. The resulting risk estimates are 3 % of the chronic PAD (% cPAD) for the U.S. Population and 11 % of the cPAD for Children 1-6 years of age (highest exposed population subgroup) and 6 % of the cPAD for Children 7-12 yrs. The remaining population subgroups were ≤ 5 % of the cPAD (Table 18) when the feeding studies were adjusted using the ratio of ppm TRR/ppm lindane identified in the metabolism studies (Table 18).

## **Toxicological Information**

Memoranda providing details of relevant toxicological information include the HIARC report dated 7/27/00 and the FQPA Safety Factor Committee report dated 8/2/00.

The acute and chronic FQPA safety factors of 10X were reduced to 3X (see FQPA Safety Factor Document, 8/2/00). A reference dose (RfD) which includes the FQPA safety factor (10X, 3X or 1X) is defined as the Population Adjusted Dose (PAD). Doses and endpoints for dietary risk assessment are presented in Table 1.

The OPP/Cancer Assessment Review Committee (CARC) has completed the review of newly submitted carcinogenicity study in CD-1 mice along with other data. In accordance with the EPA Draft Guidelines for Carcinogen Risk Assessment (July, 1999), the CARC has classified lindane into the category "**Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential**" based on an increased incidence of benign lung tumors in female mice only. The Committee, therefore, recommended that the quantification of human cancer risk is not required.

Table 1. Lindane: Toxicological Doses and Endpoints for Dietary Risk Assessment.

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT	STUDY TYPE/MRID
Acute Dietary- general population	NOAEL= 6 mg/kg UF = 100 FQPA = 3X	LOAEL is 20 mg/kg based on increased grip strength, increased Motor Activity	Acute Neurotoxicity in Rats/ 44769201
<b>Acute RfD (Gen. Pop.) = 0.06 mg/kg/day</b> <b>Acute Population Adjusted Dose (aPAD) = 0.02 mg/kg/day</b>			
Chronic Dietary	NOAEL=10 ppm (0.47 mg/kg/day)  UF = 100 FQPA = 3X	LOAEL is 100 ppm (4.81 mg/kg/day) periacinar hepatocyte hypertrophy, increased liver/spleen weight, and increased platelets	Chronic Feeding and Carcinogenicity in Rats 41094101 41853701 42891201
	<b>Chronic RfD = 0.0047 mg/kg/day</b> <b>Chronic Population Adjusted Dose (cPAD) = 0.0016 mg/kg/day</b>		

### Consumption Data

HED conducts dietary risk assessments using the Dietary Exposure Evaluation Model (DEEM™), which incorporates consumption data generated in USDA's Continuing Surveys of Food Intakes by Individuals (CSFII), 1989-1992. For acute dietary risk assessments, the entire distribution of single day food consumption events is combined with either a single residue level (deterministic analysis, risk at 95th percentile of exposure reported) or a distribution of residues (probabilistic analysis, referred to as "Monte Carlo," with risk at 99.9th percentile of exposure reported) to obtain a distribution of exposures in mg/kg/day. For chronic dietary risk assessments, the three-day average of consumption for each sub-population is combined with average residues in/on commodities to determine an average exposure in mg/kg/day.

### Residue Information

Tolerances for residues of lindane in/on food and feed commodities are currently established under 40 CFR §180.133 and are expressed in terms of lindane *per se*. The nature of the residue in plants and ruminants is not adequately understood. New nature of the residue studies from seed treatment are required for a cereal grain, leafy vegetable, and radish. Additional data are required for the ruminant metabolism study. The nature of the residue in poultry is adequately understood. The HED Metabolism Assessment Review Committee (T. Morton, 8/30/00, D267069) concluded that the TRRs should be used for risk assessment purposes and calculation of dietary burdens, pending receipt of additional metabolism data. The anticipated residues (ARs) were presented to the HED ChemSAC on 9/6/00. Exposure to lindane was determined by using the ratio (ppm TRR/ppm lindane parent) from the livestock metabolism studies. The Biological and Economic Analysis Division (OPP/BEAD) verified the registrant's percent market share estimate for lindane (I. Yusuf email, 7/17/00). The usage data are provided as Attachment 1; inclusion of the data in dietary exposure analyses is discussed below. A canola processing study for lindane was recently reviewed (T. Morton, D269388, 5/10/01). Lindane was not detected in bleached/deodorized canola oil (<0.005 ppm). Therefore, ½

LOQ (0.0025 ppm) will be used as the DEEM™ adjustment factor 1. DEEM™ default concentrations factors (adjustment factor 1) will be used for all other concentration factors. The wheat grain and forage TRRs were translated to barley, oats, and rye. The corn grain and forage TRRs were translated to sorghum.

The following metabolism and feeding studies were used to determine the appropriate residue values to be used in both the dietary burden calculation and the DEEM™ input files.

Seed Treatment Metabolism Study (N. Dodd, 3/24/88, RCB 3259, MRID 40431207)

Various seeds were treated with <sup>14</sup>C lindane. Spring wheat seeds were treated at 370 ppm (0.3x), field corn seeds at 1800 ppm (0.8x), and sweet corn seeds at 1400 ppm (0.6x). Seeds were then planted outdoors. Samples were analyzed for radioactivity periodically by oxidative combustion and autoradiography. Samples were extracted and analyzed for <sup>14</sup>C by liquid scintillation counting (LSC) and for lindane by gas liquid chromatography (GLC) when significant residues were found by combustion. This study was deemed inadequate due to insufficient characterization/identification of the radioactive residues. A new nature of the residue study from seed treatment is required for a cereal grain. The HED MARC (T. Morton, 8/30/00, D267069) concluded that the TRRs should be used for calculation of dietary burdens. The TRRs are summarized in the following table.

Table 2. Summary of TRR in various crops after seed treatment with <sup>14</sup>C labeled lindane.

Crop Matrix	TRR (ppm)
Field corn root	0.340
Field corn foliage	0.064
Field corn grain	< 0.01
Sweet corn foliage	0.051
Sweet corn grain	< 0.01
Wheat foliage	2.925
Wheat grain	0.052

The TRR used for barley, canola, oats, rye, and wheat grain was 0.052 ppm. The TRR value used for corn grain and sorghum grain was 0.01 ppm.

Meat, Milk, Poultry, & Eggs

The following acute dietary burdens (Table 3) were calculated using the appropriate TRRs from the seed treatment metabolism study presented in the previous table (Table 2). The chronic dietary burdens (Table 4) have incorporated the percent market share of the feed item into the dietary contribution.

Table 3. Lindane Acute Dietary Burden.

Feed Commodity	% Dry Matter	% Diet	Anticipated Residue (ppm)	Dietary Contribution (ppm)
<b>Beef Cattle</b>				
Field corn grain	88	50	0.01	0.0057
Wheat forage	25	25	2.925	2.925
Sorghum forage	35	15	0.064	0.028
Wheat grain	89	10	0.052	0.006
<b>Total</b>		100		<b>2.96</b>
<b>Dairy Cattle</b>				
Field corn grain	88	40	0.01	0.0045
Wheat grain	89	10	0.052	0.006
Wheat forage	25	50	2.925	5.85
<b>Total</b>		100		<b>5.86</b>
<b>Poultry</b>				
Field corn grain	NA	20	0.01	0.002
Wheat grain	NA	80	0.052	0.0416
<b>Total</b>		100		<b>0.044</b>
<b>Swine</b>				
Field corn grain	NA	20	0.01	0.002
Wheat grain	NA	80	0.052	0.0416
<b>Total</b>		100		<b>0.044</b>

Table 4. Lindane Chronic Dietary Burden.

Feed Commodity	% Dry Matter	% Diet	Anticipated Residue (ppm)	Percent Market Share	Dietary Contribution (ppm)
<b>Beef Cattle</b>					
Field corn grain	88	50	0.01	0.15	0.0009
Wheat forage	25	25	2.925	0.03	0.0878
Sorghum forage	35	15	0.064	0.03	0.0008
Wheat grain	89	10	0.052	0.03	0.0002
<b>Total</b>		100			<b>0.0897</b>
<b>Dairy Cattle</b>					
Field corn grain	88	40	0.01	0.15	0.0007
Wheat grain	89	10	0.052	0.03	0.0002
Wheat forage	25	50	2.925	0.03	0.1755
<b>Total</b>		100			<b>0.1764</b>
<b>Poultry</b>					
Field corn grain	NA	20	0.01	0.15	0.0003
Wheat grain	NA	80	0.052	0.03	0.0012
<b>Total</b>		100			<b>0.0015</b>
<b>Swine</b>					
Field corn grain	NA	20	0.01	0.15	0.0003
Wheat grain	NA	80	0.052	0.03	0.0012
<b>Total</b>		100			<b>0.0015</b>

Ruminant Metabolism Study (MRID 44867104)

Lactating goats were orally administered  $^{14}\text{C}$ -Lindane capsules (via balling gun) immediately after the morning milking once per day for 7 days. The actual dose rate was 13 mg/kg. This dose rate is equivalent to approximately a 2x exaggerated rate for dairy cattle and approximately 4.4x for beef cattle based on an acute dietary burden as calculated by HED. The acute anticipated residues using the TRR alone for cattle and swine are summarized in Table 6 and 7. The chronic anticipated residues using the TRR alone for cattle and swine are summarized in Table 8 and 9.

Table 5. Summary of TRR characterized/identified in tissues of lactating goats orally dosed with  $^{14}\text{C}$ -Lindane at 13 ppm.

Tissue	Total Radioactive Residue (TRR) ppm
Fat	3.46 ppm
Liver	2.25 ppm
Kidney	0.48 ppm
Muscle	0.20 ppm
Milk Fat	0.136 ppm

Table 6. Cattle Acute Anticipated Residues From Nature of the residue study (M. Kovacs Jr., 9/20/88, RCB 4037).

Tissue	13 ppm Feeding Level (4.4X) <sup>a</sup>	Cattle AR
Fat	$3.46/4.4=0.786$	0.786 ppm
Muscle	$0.2/4.4=0.045$	0.045 ppm
Milk Fat	$0.136/2=0.068$	0.068 ppm
Liver	$2.25/4.4=0.511$	0.511 ppm <sup>b</sup>
Kidney	$0.48/4.4=0.109$	0.109 ppm

<sup>a</sup> The 13 ppm feeding level represented 2x the dairy dietary burden.

<sup>b</sup> Use for liver, meat byproducts, and other organ meats for beef, goat, horses, sheep, and veal.

Table 7. Swine Acute Anticipated Residues based on metabolism data from the ruminant metabolism study.

Tissue	13 ppm Feeding Level (295X)	Swine AR
Fat	$3.46/295=0.012$	0.012 ppm
Muscle	$0.2/295=0.001$	0.001 ppm
Liver	$2.25/295=0.008$	0.008 ppm <sup>a</sup>
Kidney	$0.48/295=0.002$	0.002 ppm

<sup>a</sup> Use for liver, meat byproducts, and other organ meats for pork.

Table 8. Cattle Chronic Anticipated Residues From Nature of the residue study (M. Kovacs Jr., 9/20/88, RCB 4037).



Tissue	13 ppm Feeding Level (145X) <sup>a</sup>	Cattle AR
Fat	3.46/145=0.02	0.02 ppm
Muscle	0.2/145=0.001	0.001 ppm
Milk Fat	0.136/74=0.002	0.002 ppm
Liver	2.25/145=0.02	0.02 ppm <sup>b</sup>
Kidney	0.48/145=0.003	0.003 ppm

<sup>a</sup> The 13 ppm feeding level represented 74x the chronic dairy dietary burden.

<sup>b</sup> Use for liver, meat byproducts, and other organ meats for beef, goat, horses, sheep, and veal.

Table 9. Swine Chronic Anticipated Residues based on metabolism data from the ruminant metabolism study.

Tissue	13 ppm Feeding Level (8700X)	Swine AR
Fat	3.46/8700=0.0004	0.0004 ppm
Muscle	0.2/8700=0.00002	0.00002 ppm
Liver	2.25/8700=0.0003	0.0003 ppm <sup>a</sup>
Kidney	0.48/8700=0.00006	0.00006 ppm

<sup>a</sup> Use for liver, meat byproducts, and other organ meats for pork.

### Poultry Metabolism Study (MRID 40271301)

Following 4 days of dosing with [<sup>14</sup>C]lindane at levels equivalent to 120 (2700x) ppm in the acute diet, <sup>14</sup>C-residues accumulated to the greatest extent in fatty tissues. In the high-dose hens, TRRs were highest in fat (96.98 ppm) followed by skin (49.93 ppm), thigh muscle (11.81 ppm), liver (11.65 ppm), and breast muscle (1.44 ppm).

<sup>14</sup>C-Residues were readily extracted (80-141% TRR) from yolks, thigh muscle, liver, skin, and fat of high-dose hens using organic solvents, and 66.4-121.3% of the TRR was subsequently identified. Lindane was the principal <sup>14</sup>C-residue identified in eggs and tissues, accounting for 94.5% of the TRR in egg yolks, 70.8-86.0% of the TRR in muscle, skin, and fat, and 51.5% of the TRR in liver. 1,2,4-Trichlorobenzene was identified as accounting for 19.4% of the TRR in liver, and 0.6-3.5% of the TRR in egg yolks and other tissues. 1,3,5-Trichlorobenzene and dichlorobenzene(s) were also detected in liver at 6.4 and 9.5% of the TRR, respectively. Tetrachlorobenzene (either 1,2,4,5- or 1,2,3,4-) was detected in thigh muscle at 17.7% of the TRR and in other tissues at 2.2-3.1% of the TRR. Pentachlorocyclohexene was identified as accounting for 3.8-6.1% of the TRR in yolks and tissues. The remaining metabolites (1,2,3,4-tetrachlorobenzene/ tetrachlorocyclohexene; 1,2,3,4,5-pentachlorobenzene; and hexachlorocyclohexene) detected in tissues and/or yolks each accounted for ≤4.4% of the TRR. The acute anticipated residues using the TRR alone for poultry are summarized in Table 10. The chronic anticipated residues using the TRR alone for poultry are summarized in Table 11.

Table 10. Summary of TRR characterized/identified in tissues of laying hens orally dosed with <sup>14</sup>C-Lindane at 120 ppm (2700x acute dietary burden) normalized to 1x the acute dietary burden.

Tissue	Total Radioactive Residue (TRR) ppm	Acute Anticipated Residue (ppm)
Fat	97.0 ppm/2700=0.04	0.04
Liver	11.7 ppm/2700=0.004	0.004
Skin	49.9 ppm/2700=0.02	0.02*
Thigh	11.8 ppm/2700=0.004	0.004
Egg White	0.21/2700=0.00008	0.00008
Egg Yolk	10.8 ppm/2700=0.004	0.004
Whole Egg		0.7(0.00008)+0.3(0.004)=0.001

\*Use for poultry meat byproducts

Table 11. Summary of TRR characterized/identified in tissues of laying hens orally dosed with <sup>14</sup>C-Lindane at 120 ppm (80000x acute dietary burden) normalized to 1x the chronic dietary burden.

Tissue	Total Radioactive Residue (TRR) ppm	Chronic Anticipated Residue (ppm)
Fat	97.0 ppm/80000=0.001	0.001
Liver	11.7 ppm/80000=0.0001	0.0001
Skin	49.9 ppm/80000=0.0006	0.0006*
Thigh	11.8 ppm/80000=0.0001	0.0001
Egg White	0.21/80000=0.000003	0.000003
Egg Yolk	10.8 ppm/80000	0.0001
Whole Egg		0.7(0.000003)+0.3(0.0001)=0.00003

\*Use for poultry meat byproducts

### Ruminant Feeding Study (M. Kovacs Jr., 9/20/88, RCB 4037)

Dairy cattle were fed at three feeding levels of 20 ppm (6.7x acute beef cattle dietary burden), 60 ppm (20x acute beef cattle dietary burden), and 200 ppm (67x acute beef cattle dietary burden). The exaggerated feeding rates correspond to 3.4x, 10x, and 34x for the acute dairy cattle dietary burden, respectively. The exaggerated feeding rates correspond to 450x, 1400x, and 4500x for the acute swine dietary burden, respectively. The acute anticipated residues for cattle and swine using the feeding studies along with information from the metabolism studies are summarized in Tables 12 and 13. The chronic anticipated residues for cattle and swine using the feeding studies along with information from the metabolism studies are summarized in Tables 14 and 15.

Table 12. Summary of lindane residues in cattle fed at 20, 60, and 200 ppm normalized to a 1x acute feeding level.

Sample	20 ppm (6.7x) <sup>a</sup>	60 ppm (20x) <sup>a</sup>	200 ppm (67x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Milk (Day 7)	0.41/3.4 = 0.120	1.64/10 = 0.164	3.95/34 = 0.116	0.133 * 1.22 = 0.163
Liver	0.10/6.7 = 0.015	0.19/20 = 0.009	0.72/67 = 0.011	0.012 * 6.25 = 0.073
Kidney	0.34/6.7 = 0.051	1.07/20 = 0.053	4.57/67 = 0.068	0.057 * 2.82 = 0.162
Muscle	0.97/6.7 = 0.145	1.80/20 = 0.090	8.75/67 = 0.130	0.122 * 1.25 = 0.152
Fat	11.9/6.7 = 1.78	20.2/20 = 1.01	58.1/67 = 0.87	1.22 * 1.18 = 1.44

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

Table 13. Summary of lindane residues in swine translated from the cattle feeding study and normalized to 1x acute feeding level.

Sample	20 ppm (450x) <sup>a</sup>	60 ppm (1400x) <sup>a</sup>	200 ppm (4500x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Liver	0.10/450=0.0002	0.19/1400=0.0001	0.72/4500= 0.0002	0.0002 * 6.25 = 0.001
Kidney	0.34/450=0.0007	1.07/1400=0.0008	4.57/4500=0.001	0.0008 * 2.82 = 0.002
Muscle	0.97/450=0.002	1.80/1400=0.001	8.75/4500=0.002	0.002 * 1.25 = 0.002
Fat	11.9/450=0.026	20.2/1400=0.014	58.1/4500=0.013	0.018 * 1.18 = 0.021

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

Table 14. Summary of lindane residues in cattle fed at 20, 60, and 200 ppm normalized to a 1x chronic feeding level.

Sample	20 ppm (223x) <sup>a</sup>	60 ppm (669x) <sup>a</sup>	200ppm(2230x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Milk (Day 7)	0.41/113= 0.004	1.64/340=0.005	3.95/1134=0.003	0.004 * 1.22 = 0.005
Liver	0.10/223=0.0004	0.19/669=0.0003	0.72/2230=0.0003	0.0003 * 6.25 = 0.002
Kidney	0.34/223=0.002	1.07/669=0.002	4.57/2230=0.002	0.002 * 2.82 = 0.006
Muscle	0.97/223=0.004	1.80/669=0.003	8.75/2230=0.004	0.004 * 1.25 = 0.005
Fat	11.9/223=0.05	20.2/669=0.03	58.1/2230=0.03	0.04 * 1.18 = 0.05

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

Table 15. Summary of lindane residues in swine translated from the cattle feeding study and normalized to 1x chronic

feeding level.

Sample	20 ppm (13300x) <sup>a</sup>	60 ppm (40000x) <sup>a</sup>	200 ppm (133000x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Liver	0.10/13300=0.000008	0.19/40000=0.000005	0.72/133000=0.000005	0.000006 * 6.25 = 0.00004
Kidney	0.34/13300=0.00003	1.07/40000=0.00003	4.57/133000=0.00003	0.00003 * 2.82 = 0.00008
Muscle	0.97/13300=0.00007	1.80/40000=0.00005	8.75/133000=0.00007	0.00006 * 1.25 = 0.00008
Fat	11.9/13300=0.0009	20.2/40000=0.0005	58.1/133000=0.0004	0.0006 * 1.18 = 0.0007

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

#### Poultry Feeding Study (G. Otakie, 8/31/88, RCB 4034)

Poultry were fed lindane at 1.5 (34x the acute dietary burden), 4.5 (102x the acute dietary burden), and 15 (340x the acute dietary burden) ppm feeding levels. The acute anticipated residues for poultry using the feeding study along with information from the metabolism study are summarized in Table 16. The chronic anticipated residues for poultry using the feeding study along with information from the metabolism study are summarized in Table 17.

Table 16. Summary of lindane residues in poultry fed at 1.5, 4.5, and 15 ppm normalized to a 1x acute feeding level.

Sample	1.5 ppm (34x) <sup>a</sup>	4.5 ppm (102x) <sup>a</sup>	15 ppm (340x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Eggs	0.216/34 = 0.006	0.672/102 = 0.006	2.357/340 = 0.007	0.006 * 1.06 = 0.006
Liver	0.12/34 = 0.003	0.51/102 = 0.005	0.78/340 = 0.002	0.003 * 1.95 = 0.006
Heart	0.33/34 = 0.010	0.89/102 = 0.009	2.26/340 = 0.007	0.009 * 1 = 0.009 <sup>c</sup>
Thigh	0.19/34 = 0.005	0.36/102 = 0.003	1.35/340 = 0.004	0.004 * 1.40 = 0.006
Fat	2.54/34 = 0.075	7.8/102 = 0.076	27.7/340 = 0.081	0.077 * 1.17 = 0.090

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

<sup>c</sup> 100% of the TRR in the chicken heart was identified as lindane. This residue was used for chicken byproducts, chicken giblets (excl. liver), turkey byproducts, turkey other organ meats, and turkey giblets (excl. liver).

Table 17. Summary of lindane residues in poultry fed at 1.5, 4.5, and 15 ppm normalized to a 1x chronic feeding level.

Sample	1.5 ppm (1000x) <sup>a</sup>	4.5 ppm (3000x) <sup>a</sup>	15 ppm (10000x) <sup>a</sup>	Average (ppm) * (ppm TRR/ppm lindane) <sup>b</sup>
Eggs	0.216/1000=0.0002	0.672/3000=0.0002	2.357/10000=0.0002	0.002 * 1.06 = 0.0002
Liver	0.12/1000=0.0001	0.51/3000=0.0002	0.78/10000=0.00008	0.0001 * 1.95 = 0.0002
Heart	0.33/1000=0.0003	0.89/3000=0.0003	2.26/10000=0.0002	0.0003 * 1 = 0.0003 <sup>c</sup>
Thigh	0.19/1000=0.0002	0.36/3000=0.0001	1.35/10000=0.0001	0.0001 * 1.40 = 0.0002
Fat	2.54/1000=0.003	7.8/3000=0.003	27.7/10000=0.003	0.003 * 1.17 = 0.004

<sup>a</sup> First number in column is residue value from feeding study which is then divided by the exaggerated feeding rate.

<sup>b</sup> Average residue value from three feeding levels multiplied by the ratio of (ppm TRR/ppm lindane) in metabolism study.

<sup>c</sup> 100% of the TRR in the chicken heart was identified as lindane. This residue was used for chicken byproducts, chicken giblets (excl. liver), turkey byproducts, turkey other organ meats, and turkey giblets (excl. liver).

## Uncertainties

There are no adequate nature of the residue studies for plants from seed treatment application. A new metabolism study is required for a grain crop; however, a seed treatment metabolism study (which was classified as inadequate) was reviewed by HED and used in the determination of the TRR for use in this dietary exposure analysis. The wheat grain and forage TRRs were translated to barley, oats, and rye. The corn grain and forage TRRs were translated to sorghum. The nature of the residue in poultry is understood. The nature of the residue in livestock is adequately understood. The magnitude of the residue studies in poultry and cattle only analyzed for lindane. The lindane residue values were derived using a ratio of total radioactive residue divided by the amount of lindane present in the livestock metabolism studies. This would be worst case estimate since we are assuming that all of the TRR would be residues of concern and adjusting the lindane residues in the livestock magnitude of the residue studies accordingly to account for the TRR.

The dietary exposure analyses using the total radioactive residues is a Tier 3 assessment since percent crop treated was used in the analyses. The dietary exposure analyses that were based on the adjustment of the lindane residues in the feeding studies is a Tier 3 assessment. Percent market share was available for all crops included in the analyses. Since lindane is being supported for reregistration for seed treatments only, there is no difference in the percent crop treated values between crops grown for the fresh market and those grown for processing. A processing study was available for canola only; the default DEEM™ processing factors were used for all other foods.

## Results/Discussion

Estimated acute dietary exposure is below HED's level of concern for all population subgroups at the 99.9<sup>th</sup> percentile. The maximum dietary risk estimate is 17 % of the aPAD for All Infants when the feeding studies were adjusted using the metabolism studies (Table 18).

Estimated chronic dietary risk is below HED's level of concern for all population subgroups. The resulting risk estimates are 3 % of the chronic PAD (% cPAD) for the U.S. Population and 11 % of the cPAD for Children 1-6 years of age (highest exposed population subgroup) and 6 % of the cPAD for Children 7-12 yrs. The remaining population subgroups were  $\leq 5$  % of the cPAD (Table 18) when the feeding studies were adjusted using the ratio of ppm TRR/ppm lindane identified in the metabolism studies (Table 18).

Table 18. Estimated Acute and Chronic Dietary Exposure and Risk using the feeding studies and adjusting lindane residues using the metabolism studies.

Population Subgroup	Acute (99.9th %-ile)		Chronic	
	Exposure (mg/kg/day)	%aPAD	Exposure (mg/kg/day)	% cPAD
U.S. Population	0.001305	7	0.000054	3
All infants (<1 yr)	0.003320	17	0.000072	5
Children (1-6 yrs)	0.001973	10	0.000173	11
Children (7-12 yrs)	0.001088	5	0.000096	6
Females (13-50 yrs)	0.000467	2	0.000034	2
Males (13-19 yrs)	0.000670	3	0.000061	4
Males (20+ yrs)	0.000458	2	0.000034	2
Seniors (55+ yrs)	0.000409	2	0.000030	2

cc : Chem F, Chron F. Morton , L. Richardson

RDI:Chemistry SAC (9/6/00); DE SAC (9/25/00) (S. Piper, 12/13/01 & D. Soderberg, 12/13/01); SVH:12/13/01

TM, Thurston Morton, Rm. 816D CM2, 305-6691, mail code 7509C

List of Attachments:

- Attachment 1: Quantitative Usage Analysis, 7/17/00 (I. Yusuf, BEAD/OPP).
- Attachment 2: Residue Distribution Files.
- Attachment 3: Residue Information.
- Attachment 4: Acute Analysis.
- Attachment 5: Chronic Analysis.

**Attachment 1: Quantitative Usage Analysis, 7/17/00 (I. Yusuf, BEAD/OPP).**

(Registrant submission approved by BEAD)

From the Small Grains petition, Page 79.

- B. Market share representing maximum percent of crop treated is 15% for field corn, 10% for canola, 1% for sweet corn, and 3% each for wheat, oats, barley, and grain sorghum.

From the Small Grains petition, Page 35

## **MARKET SHARE**

Reasonable estimates for the percentage of seeds of wheat, barley, oats, rye, and sorghum treated with lindane *i.e.*, the market share, are 1% to 3%. The market share on corn may be as high as 15%. Market share information was used in calculations of Maximum Theoretical Dietary Burdens for livestock, and was considered in some estimations of human dietary exposure.

From the vegetables petition, Page 22.

## **MARKET SHARE:**

Reasonable estimates for the percentage of acres employing lindane-treated seeds are: corn 15%, brassica < 1%, leafy vegetables < 1%, and radishes < 1%. (Personal Communication: T. McArtle, Trace Chemical and Seed Treatment Coalition representative, December 1998).

## **Attachment 2: RDFs**

Documentation:doc beef fat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85

TOTALFREQ=1

15,1.44

Documentation:doc beef meat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.152

Documentation:doc beef meat by products lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.162

Documentation:doc beef liver lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.073

Documentation:doc milk lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.163

Documentation:doc poultry eggs lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.006

Documentation:doc poultry meat byproducts lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.009

Documentation:doc poultry liver lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1  
15,0.006



Documentation:doc poultry giblets lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.009

Documentation:doc poultry fat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.09

Documentation:doc poultry meat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.006

Documentation:doc swine fat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.021

Documentation:doc swine meat byproducts lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.002

Documentation:doc swine liver lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.001

Documentation:doc swine meat lindane  
DOC ASSUMING 15% crop treated for highest feed item  
TOTALZ=85  
TOTALFREQ=1

15,0.002

### **Attachment 3: Residue Information**

#### **Acute Analysis using feeding study**

File name : C : \ d e e m \ 0 0 9 0 0 1 \ R e v i s e d  
Analysis\12-11-01\12-11-01RevacuteTRR.RS7

Chemical: Lindane

RfD(Chronic): .0016 mg/kg bw/day NOEL(Chronic): .47 mg/kg bw/day

RfD(Acute): .02 mg/kg bw/day NOEL(Acute): 6 mg/kg bw/day Q\*= 1.1

Date created/last modified: 12-03-2001/05:14:17/8 Program

ver. 7.75

Comment: Reference doses have 3X FQPA factored in. This is a dietary analysis using the total radioactive residues from the plant and animal metabolism studies.

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RDL indices and parameters for Monte Carlo Analysis:

Index #	Dist Code	Parameter #1	Param #2	Param #3
---------	-----------	--------------	----------	----------

1	6	beefmeat.rdf		
2	6	beeffat.rdf		
3	6	beefliver.rdf		
4	6	beefmbyp.rdf		
5	6	poultryegg.rdf		
6	6	poultryfat.rdf		
7	6	poultrygiblets.rdf		
8	6	poultryliver.rdf		
9	6	poultrymbyp.rdf		
10	6	poultrymeat.rdf		
11	6	swinefat.rdf		
12	6	swineliver.rdf		
13	6	swinembyp.rdf		
14	6	swinemeat.rdf		
15	6	milk.rdf		

Food Code	Crop Grp	Food Name	Def Res (ppm)	Adj.Factors #1	#2
265	15	Barley	0.052000	1.000	
0.030					
323	M	Beef-dried	0.045000	1.920	
0.150	1				

324 M	Beef-fat w/o bones	0.786000	1.000
0.150 2			
325 M	Beef-kidney	0.109000	1.000
0.150 4			
327 M	Beef-lean (fat/free) w/o bones	0.045000	1.000
0.150 1			
326 M	Beef-liver	0.511000	1.000
0.150 3			
321 M	Beef-meat byproducts	0.511000	1.000
0.150 4			
322 M	Beef-other organ meats	0.511000	1.000
0.150 4			
301 O	Canola oil (rape seed oil)	0.002500	1.000
0.100			
366 P	Chicken-byproducts	0.004000	1.000
0.150 9			
368 P	Chicken-fat w/o bones	0.040000	1.000
0.150 6			
367 P	Chicken-giblets(liver)	0.004000	1.000
0.150 8			
385 P	Chicken-giblets (excl. liver)	0.004000	1.000
0.150 7			
369 P	Chicken-lean/fat free w/o bones	0.004000	1.000
0.150 10			
267 15	Corn grain-bran	0.010000	1.000
0.150			
266 15	Corn grain-endosperm	0.010000	1.000
0.150			
289 15	Corn grain-oil	0.010000	1.000
0.150			
268 15	Corn grain/sugar/hfcs	0.010000	1.500
0.150			
388 15	Corn grain/sugar-molasses	0.010000	1.500
0.150			
237 15	Corn/pop	0.010000	1.000
0.150			
238 15	Corn/sweet	0.010000	1.000
0.010			
364 P	Eggs-white only	0.000080	1.000
0.150 5			
363 P	Eggs-whole	0.001000	1.000
0.150 5			

365 P	Eggs-yolk only	0.004000	1.000
0.150 5			
330 M	Goat-fat w/o bone	0.786000	1.000
0.150 2			
331 M	Goat-kidney	0.109000	1.000
0.150 4			
333 M	Goat-lean (fat/free) w/o bone	0.045000	1.000
0.150 1			
332 M	Goat-liver	0.511000	1.000
0.150 3			
328 M	Goat-meat byproducts	0.511000	1.000
0.150 4			
329 M	Goat-other organ meats	0.511000	1.000
0.150 4			
334 M	Horsemeat	0.045000	1.000
0.150 1			
398 D	Milk-based water	0.068000	1.000
0.150 15			
319 D	Milk-fat solids	0.068000	1.000
0.150 15			
318 D	Milk-nonfat solids	0.068000	1.000
0.150 15			
320 D	Milk sugar (lactose)	0.068000	1.000
0.150 15			
399 15	Oats-bran	0.052000	1.000
0.030			
269 15	Oats	0.052000	1.000
0.030			
344 M	Pork-fat w/o bone	0.012000	1.000
0.150 11			
345 M	Pork-kidney	0.002000	1.000
0.150 13			
347 M	Pork-lean (fat free) w/o bone	0.001000	1.000
0.150 14			
346 M	Pork-liver	0.008000	1.000
0.150 12			
342 M	Pork-meat byproducts	0.008000	1.000
0.150 13			
343 M	Pork-other organ meats	0.008000	1.000
0.150 13			
362 P	Poultry-other-fat w/o bones	0.040000	1.000
0.150 6			

361 P	Poultry-other-giblets(liver)	0.004000	1.000
0.150 8			
360 P	Poultry-other-lean (fat free) w/	0.004000	1.000
0.150 10			
274 15	Rye-flour	0.052000	1.000
0.030			
273 15	Rye-germ	0.052000	1.000
0.030			
272 15	Rye-rough	0.052000	1.000
0.030			
338 M	Sheep-fat w/o bone	0.786000	1.000
0.150 2			
339 M	Sheep-kidney	0.109000	1.000
0.150 4			
341 M	Sheep-lean (fat free) w/o bone	0.045000	1.000
0.150 1			
340 M	Sheep-liver	0.511000	1.000
0.150 3			
336 M	Sheep-meat byproducts	0.511000	1.000
0.150 4			
337 M	Sheep-other organ meats	0.511000	1.000
0.150 4			
275 15	Sorghum (including milo)	0.010000	1.000
0.030			
355 P	Turkey-byproducts	0.004000	1.000
0.150 9			
357 P	Turkey--fat w/o bones	0.040000	1.000
0.150 6			
356 P	Turkey-giblets (liver)	0.004000	1.000
0.150 8			
358 P	Turkey- lean/fat free w/o bones	0.004000	1.000
0.150 10			
449 P	Turkey-other organ meats	0.004000	1.000
0.150 9			
429 M	Veal-dried	0.045000	1.920
0.150 1			
424 M	Veal-fat w/o bones	0.786000	1.000
0.150 2			
426 M	Veal-kidney	0.109000	1.000
0.150 4			
425 M	Veal-lean (fat free) w/o bones	0.045000	1.000
0.150 1			

427 M		Veal-liver	0.511000	1.000
0.150	3			
430 M		Veal-meat byproducts	0.511000	1.000
0.150	4			
428 M		Veal-other organ meats	0.511000	1.000
0.150	4			
278 15		Wheat-bran	0.052000	1.000
0.030				
279 15		Wheat-flour	0.052000	1.000
0.030				
277 15		Wheat-germ	0.052000	1.000
0.030				
437 15		Wheat-germ oil	0.052000	1.000
0.030				
276 15		Wheat-rough	0.052000	1.000
0.030				

Chronic Analysis using feeding study

File name : C : \ d e e m \ 0 0 9 0 0 1 \ R e v i s e d  
Analysis\12-11-01\12-11-01RevchronicTRR.RS7

Chemical: Lindane

RfD(Chronic): .0016 mg/kg bw/day NOEL(Chronic): .47 mg/kg bw/day

RfD(Acute): .02 mg/kg bw/day NOEL(Acute): 6 mg/kg bw/day Q\*= 1.1

Date created/last modified: 12-03-2001/05:15:47/8 Program

ver. 7.75

Comment: Feference doses have 3X FQPA factored in. This is the dietary analysis using the metabolism and feeding studies.

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Food Crop      Def Res      Adj.Factors
Code  Grp  Food Name      (ppm)      #1      #2
-----
-----
265  15  Barley      0.052000      1.000
0.030
323  M  Beef-dried      0.005000      1.920
1.000
324  M  Beef-fat w/o bones      0.050000      1.000
1.000
325  M  Beef-kidney      0.006000      1.000

```

1.000					
327	M	Beef-lean (fat/free) w/o bones	0.005000	1.000	
1.000					
326	M	Beef-liver	0.002000	1.000	
1.000					
321	M	Beef-meat byproducts	0.006000	1.000	
1.000					
322	M	Beef-other organ meats	0.006000	1.000	
1.000					
301	O	Canola oil (rape seed oil)	0.002500	1.000	
0.100					
366	P	Chicken-byproducts	0.000300	1.000	
1.000					
368	P	Chicken-fat w/o bones	0.004000	1.000	
1.000					
367	P	Chicken-giblets(liver)	0.000200	1.000	
1.000					
385	P	Chicken-giblets (excl. liver)	0.000300	1.000	
1.000					
369	P	Chicken-lean/fat free w/o bones	0.000200	1.000	
1.000					
267	15	Corn grain-bran	0.010000	1.000	
0.150					
266	15	Corn grain-endosperm	0.010000	1.000	
0.150					
289	15	Corn grain-oil	0.010000	1.000	
0.150					
268	15	Corn grain/sugar/hfcs	0.010000	1.500	
0.150					
388	15	Corn grain/sugar-molasses	0.010000	1.500	
0.150					
237	15	Corn/pop	0.010000	1.000	
0.150					
238	15	Corn/sweet	0.010000	1.000	
0.010					
364	P	Eggs-white only	0.000200	1.000	
1.000					
363	P	Eggs-whole	0.000200	1.000	
1.000					
365	P	Eggs-yolk only	0.000200	1.000	
1.000					
330	M	Goat-fat w/o bone	0.050000	1.000	

1.000					
331	M	Goat-kidney	0.006000	1.000	
1.000					
333	M	Goat-lean (fat/free) w/o bone	0.005000	1.000	
1.000					
332	M	Goat-liver	0.002000	1.000	
1.000					
328	M	Goat-meat byproducts	0.006000	1.000	
1.000					
329	M	Goat-other organ meats	0.006000	1.000	
1.000					
334	M	Horsemeat	0.005000	1.000	
1.000					
398	D	Milk-based water	0.005000	1.000	
1.000					
319	D	Milk-fat solids	0.005000	1.000	
1.000					
318	D	Milk-nonfat solids	0.005000	1.000	
1.000					
320	D	Milk sugar (lactose)	0.005000	1.000	
1.000					
399	15	Oats-bran	0.052000	1.000	
0.030					
269	15	Oats	0.052000	1.000	
0.030					
344	M	Pork-fat w/o bone	0.000700	1.000	
1.000					
345	M	Pork-kidney	0.000080	1.000	
1.000					
347	M	Pork-lean (fat free) w/o bone	0.000080	1.000	
1.000					
346	M	Pork-liver	0.000040	1.000	
1.000					
342	M	Pork-meat byproducts	0.000080	1.000	
1.000					
343	M	Pork-other organ meats	0.000080	1.000	
1.000					
362	P	Poultry-other-fat w/o bones	0.004000	1.000	
1.000					
361	P	Poultry-other-giblets(liver)	0.000200	1.000	
1.000					
360	P	Poultry-other-lean (fat free) w/	0.000200	1.000	



1.000					
274	15	Rye-flour	0.052000	1.000	
0.030					
273	15	Rye-germ	0.052000	1.000	
0.030					
272	15	Rye-rough	0.052000	1.000	
0.030					
338	M	Sheep-fat w/o bone	0.050000	1.000	
1.000					
339	M	Sheep-kidney	0.006000	1.000	
1.000					
341	M	Sheep-lean (fat free) w/o bone	0.005000	1.000	
1.000					
340	M	Sheep-liver	0.002000	1.000	
1.000					
336	M	Sheep-meat byproducts	0.006000	1.000	
1.000					
337	M	Sheep-other organ meats	0.006000	1.000	
1.000					
275	15	Sorghum (including milo)	0.010000	1.000	
0.030					
355	P	Turkey-byproducts	0.000300	1.000	
1.000					
357	P	Turkey--fat w/o bones	0.004000	1.000	
1.000					
356	P	Turkey-giblets (liver)	0.000200	1.000	
1.000					
358	P	Turkey- lean/fat free w/o bones	0.000200	1.000	
1.000					
449	P	Turkey-other organ meats	0.000300	1.000	
1.000					
429	M	Veal-dried	0.005000	1.920	
1.000					
424	M	Veal-fat w/o bones	0.050000	1.000	
1.000					
426	M	Veal-kidney	0.006000	1.000	
1.000					
425	M	Veal-lean (fat free) w/o bones	0.005000	1.000	
1.000					
427	M	Veal-liver	0.002000	1.000	
1.000					
430	M	Veal-meat byproducts	0.006000	1.000	

1.000					
428	M	Veal-other organ meats	0.006000	1.000	
1.000					
278	15	Wheat-bran	0.052000	1.000	
0.030					
279	15	Wheat-flour	0.052000	1.000	
0.030					
277	15	Wheat-germ	0.052000	1.000	
0.030					
437	15	Wheat-germ oil	0.052000	1.000	
0.030					
276	15	Wheat-rough	0.052000	1.000	
0.030					

#### Attachment 4: Acute Analysis

##### Acute Analysis Using Feeding Studies

U.S. Environmental Protection Agency  
Ver. 7.74

DEEM ACUTE Analysis for LINDANE  
(1989-92 data)

Residue file: 12-11-01RevacuteTRR.RS7  
factor #2 used.

Adjustment

Analysis Date: 12-11-2001/16:09:00  
12-03-2001/05:14:17/8

Residue file dated:

NOEL (Acute) = 6.000000 mg/kg body-wt/day

Daily totals for food and foodform consumption used.

MC iterations = 5000

MC list in residue file

MC seed =

10281

Run Comment: "Reference doses have 3X FQPA factored in. This is a dietary analysis using the total radioactive residues from the plant and animal metabolism studies."

=====

Summary calculations (per capita):

95th Percentile			99th Percentile			
99.9th Percentile						
Exposure	% aRfD	MOE	Exposure	% aRfD	MOE	Exposure
% aRfD	MOE					
-----						
-----						
U.S. Population:						
0.000160	0.80	37614	0.000516	2.58	11627	0.001305
6.52	4598					
U.S. Population (spring season):						
0.000160	0.80	37390	0.000503	2.51	11934	0.001290
6.45	4650					
U.S. Population (summer season):						
0.000152	0.76	39455	0.000521	2.60	11525	0.001434
7.17	4185					
U.S. Population (autumn season):						
0.000166	0.83	36052	0.000563	2.82	10648	0.001294
6.47	4636					
U.S. Population (winter season):						
0.000161	0.80	37353	0.000478	2.39	12541	0.001221
6.10	4914					
Northeast region:						
0.000152	0.76	39479	0.000521	2.61	11510	0.001414
7.07	4243					
Midwest region:						
0.000181	0.91	33101	0.000574	2.87	10452	0.001383
6.92	4337					
Southern region:						
0.000151	0.76	39732	0.000457	2.29	13125	0.001106
5.53	5424					
Western region:						
0.000158	0.79	37994	0.000523	2.62	11466	0.001376
6.88	4360					
Hispanics:						
0.000179	0.89	33604	0.000616	3.08	9745	0.001456
7.28	4122					
Non-hispanic whites:						
0.000159	0.79	37742	0.000509	2.54	11795	0.001281
6.41	4682					
Non-hispanic blacks:						
0.000150	0.75	40040	0.000474	2.37	12662	0.001307
6.54	4590					

Non-hisp/non-white/non-black:						
0.000158	0.79	38010	0.000591	2.96	10149	0.001593
7.97	3765					
All infants:						
0.000204	1.02	29448	0.000837	4.19	7167	0.003320
16.60	1807					
Nursing infants (<1 yr old):						
0.000064	0.32	94100	0.000288	1.44	20823	0.000698
3.49	8599					
Non-nursing infants (<1 yr old):						
0.000234	1.17	25658	0.001521	7.60	3945	0.003626
18.13	1654					
Children 1-6 yrs:						
0.000668	3.34	8987	0.001264	6.32	4748	0.001973
9.86	3041					
Children 7-12 yrs:						
0.000353	1.76	17017	0.000642	3.21	9342	0.001088
5.44	5513					
Females 13+ (preg/not nursing):						
0.000191	0.95	31424	0.000342	1.71	17528	0.000509
2.54	11797					
Females 13+ (nursing):						
0.000148	0.74	40598	0.000352	1.76	17023	0.000623
3.11	9632					
Females 13-19 (not preg or nursing):						
0.000160	0.80	37405	0.000311	1.55	19293	0.000676
3.38	8874					
Females 20+ (not preg or nursing):						
0.000099	0.50	60503	0.000207	1.04	28962	0.000405
2.02	14816					
Females 13-50 yrs:						
0.000111	0.55	54255	0.000245	1.23	24444	0.000467
2.34	12844					
Males 13-19 yrs:						
0.000201	1.00	29852	0.000413	2.06	14542	0.000670
3.35	8960					
Males 20+ yrs:						
0.000106	0.53	56425	0.000225	1.13	26647	0.000458
2.29	13104					
Seniors 55+:						
0.000099	0.50	60477	0.000203	1.01	29619	0.000409
2.04	14676					

Pacific:

0.000156	0.78	38498	0.000531	2.66	11297	0.001344
6.72	4462					

## Attachment 5: Chronic Analysis

### Chronic Analysis Using Feeding Study

U.S. Environmental Protection Agency

Ver. 7.73

DEEM Chronic analysis for LINDANE

(1989-92 data)

Residue file name: C:\deem\009001\Revised  
Analysis\12-11-01\12-11-01RevchronicTRR.RS7

Adjustment

factor #2 used.

Analysis Date 12-12-2001/13:26:48

Residue file dated:

12-03-2001/05:15:47/8

Reference dose (RfD, Chronic) = .0016 mg/kg bw/day

COMMENT 1: Reference doses have 3X FQPA factored in. This is the  
dietary analysis using the metabolism and feeding studies.

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Total exposure by population subgroup

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Total Exposure

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Population	mg/kg
Percent of	
Subgroup	body wt/day
Rfd	

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U.S. Population (total)	0.000054
3.4%	

U.S. Population (spring season)	0.000054
3.3%	

U.S. Population (summer season)	0.000053
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3.3%	
U.S. Population (autumn season)	0.000056
3.5%	
U.S. Population (winter season)	0.000053
3.3%	
Northeast region	0.000053
3.3%	
Midwest region	0.000060
3.7%	
Southern region	0.000051
3.2%	
Western region	0.000053
3.3%	
Hispanics	0.000059
3.7%	
Non-hispanic whites	0.000054
3.4%	
Non-hispanic blacks	0.000049
3.1%	
Non-hisp/non-white/non-black	0.000056
3.5%	
All infants (< 1 year)	0.000072
4.5%	
Nursing infants	0.000019
1.2%	
Non-nursing infants	0.000094
5.9%	
Children 1-6 yrs	0.000173
10.8%	
Children 7-12 yrs	0.000096
6.0%	
Females 13-19 (not preg or nursing)	0.000046
2.9%	
Females 20+ (not preg or nursing)	0.000029
1.8%	
Females 13-50 yrs	0.000034
2.1%	
Females 13+ (preg/not nursing)	0.000049

3.0%	
Females 13+ (nursing)	0.000043
2.7%	
Males 13-19 yrs	0.000061
3.8%	
Males 20+ yrs	0.000034
2.1%	
Seniors 55+	0.000030
1.9%	
Pacific Region	0.000053
3.3%	

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